WHAT IS CLAIMED IS:

1. A multi-port cache memory, comprising:

first to K-th N-port tag memories each consisting of M-number of one-port cell blocks and of an N-port decoder for decoding the N cache line indices, each having 1 bit or more, supplied to the first to K-th tag memories, each of K and M being an integer of 1 or more and N being an integer of more than 1;

first to K-th N-port data memories each consisting of M-number of one-port cell blocks and of an N-port decoder for decoding the N cache line indices, each having 1 bit or more, and the N cache line offsets, each having 0 bit or more, supplied to the first to K-th data memories; and

a conflict management circuit for managing the write and read conflicts in the first to K-th N-port tag memories and the first to K-th N-port data memories.

2. The multi-port cache memory according to claim 1, wherein a cache line index consists of a first cache line index for identifying the contents of any one or any plurality of the M-number of one-port cell blocks and a second cache line index for selecting any one or any plurality of the M-number of one-port cell blocks.

3. The multi-port cache memory according to claim 1, wherein the multi-port cache memory comprises first to K-th comparing circuits for comparing the tags supplied to the first to K-th N-port tag memories with the tags generated from the first to K-th N-port tag memories, respectively, and a cache hit signal is transmitted for each of the N ports by supplying the outputs of the first to K-th comparing circuits to a K-input OR circuit for each of the N ports.

4. The multi-port cache memory according to claim 1, wherein the number M of said one-port cell blocks is less than the number N of ports of said N-port tag memory and said N-port data memory.

5. The multi-port cache memory according to claim 1, wherein

corresponding pairs of said N-port tag memories said N-port data memories are combined to form combined N-port tag-data memories, and the word length of said combined N-port tag-data memories is represented by "$mtag + W * 2^{mword}$" where mtag represents the number of bits of the address allocated to the tag, mword represents the number of bits of the address, being 0 or more, allocated to the cache line offset, and W represents the word length of an instruction or a data word.

6. The multi-port cache memory according to claim 1, wherein said cell blocks included in said N-port tag memory and said N-port data memory consist of L-port cell blocks having the number L of ports not less than 1 and less than N (1 □ L < N, L being an integer).

7. The multi-port cache memory according to claim 1, wherein said tag memory consists of $L_{tag}$-port cell blocks having the number $L_{tag}$ of ports ($L_{tag}$ being an integer not less than one), and said data memory consists of $L_{data}$-port cell blocks having the number $L_{data}$ of ports ($L_{data}$ being an integer not less than one and differing from $L_{tag}$).

8. The multi-port cache memory according to claim 2, wherein said multi-port cache memory comprises first to K-th comparing circuits for comparing the tags supplied to the first to K-th N-port tag memories with the tags generated from the first to K-th N-port tag memories, respectively, and a cache hit signal is transmitted for each of the N ports by supplying the outputs of the first to K-th comparing circuits to a K-input OR circuit for each of the N ports.

9. The multi-port cache memory according to claim 2, wherein the number M of said one-port cell blocks is less than the number N of ports of said N-port tag memory and said N-port data memory.

10. The multi-port cache memory according to claim 2, wherein corresponding pairs of said N-port tag memories and said N-port data memories are combined to

form combined N-port tag-data memories, and the word length of said combined N-port tag-data memories is represented by "mtag + $W * 2^{mword}$" where mtag represents the number of bits of the address, allocated to the tag, mword represents the number of bits of the address, being 0 or more, allocated to the cache line offset, and W represents the word length of an instruction or a data word.

11. The multi-port cache memory according to claim 2, wherein said cell blocks included in said N-port tag memory and said N-port data memory consist of L-port cell blocks having the number L of ports not less than 1 and less than N (1 □ L < N, L being an integer).

12. The multi-port cache memory according to claim 2, wherein said tag memory consists of $L_{tag}$-port cell blocks having the number $L_{tag}$ of ports ($L_{tag}$ being an integer not less than one), and said data memory consists of $L_{data}$-port cell blocks having the number $L_{data}$ of ports ($L_{data}$ being an integer not less than one and differing from $L_{tag}$).

13. The multi-port cache memory according to claim 3, wherein the outputs of said first to K-th comparing circuits control first to K-th enable circuits that permit the input and output of the write data and read data in and out of said first to K-th data memories.

14. The multi-port cache memory according to claim 3, wherein the number M of said one-port cell blocks is less than the number N of ports of said N-port tag memory and said N-port data memory.

15. The multi-port cache memory according to claim 3, wherein corresponding pairs of said N-port tag memories and said N-port data memories are combined to form combined N-port tag-data memories, and the word length of said combined N-port tag-data memories is represented by "mtag + $W * 2^{mword}$" where mtag represents the number of bits of the address allocated to the tag, mword represents the number of bits of the address, being 0 or more, allocated to the cache line

offset, and W represents the word length of an instruction or a data word.

16. The multi-port cache memory according to claim 3, wherein said cell blocks included in said N-port tag memory and said N-port data memory consist of L-port cell blocks having the number L of ports not less than 1 and less than N (1 □ L < N, L being an integer).

17. The multi-port cache memory according to claim 3, wherein said tag memory consists of $L_{tag}$-port cell blocks having the number $L_{tag}$ of ports ($L_{tag}$ being an integer not less than one), and said data memory consists of $L_{data}$-port cell blocks having the number $L_{data}$ of ports ($L_{data}$ being an integer not less than one and differing from $L_{tag}$).

18. The multi-port cache memory according to claim 8, wherein the outputs of said first to K-th comparing circuits control first to K-th enable circuits that permit the input and output of the write data and read data in and out of said first to K-th data memories.

19. The multi-port cache memory according to claim 8, wherein the number M of said one-port cell blocks is less than the number N of ports of said N-port tag memory and said N-port data memory.

20. The multi-port cache memory according to claim 8, wherein corresponding pairs of said N-port tag memories and said N-port data memories are combined to form combined N-port tag-data memories, and the word length of said combined N-port tag-data memories is represented by "mtag + $W * 2^{mword}$" where mtag represents the number of bits of the address allocated to the tag, mword represents the number of bits of the address, being 0 or more, allocated to the cache line offset, and W represents the word length of an instruction or a data word.

21. The multi-port cache memory according to claim 8, wherein said cell blocks included in said N-port tag memory and said N-port data memory consist of L-port cell blocks having the number L of ports not less than 1 and less than N (1 □ L <

N, L being an integer).

22. The multi-port cache memory according to claim 8, wherein said tag memory consists of $L_{tag}$-port cell blocks having the number $L_{tag}$ of ports ($L_{tag}$ being an integer not less than one), and said data memory consists of $L_{data}$-port cell blocks having the number $L_{data}$ of ports ($L_{data}$ being an integer not less than one and differing from $L_{tag}$).

23. The multi-port cache memory according to claim 13, wherein the number M of said one-port cell blocks is less than the number N of ports of said N-port tag memory and said N-port data memory.

24. The multi-port cache memory according to claim 13, wherein corresponding pairs of said N-port tag memories and said N-port data memories are combined to form combined N-port tag-data memories, and the word length of said combined N-port tag-data memories is represented by "$mtag + W * 2^{mword}$" where mtag represents the number of bits of the address allocated to the tag, mword represents the number of bits of the address, being 0 or more, allocated to the cache line offset, and W represents the word length of an instruction or a data word.

25. The multi-port cache memory according to claim 13, wherein said cell blocks included in said N-port tag memory and said N-port data memory consist of L-port cell blocks having the number L of ports not less than 1 and less than N (1 □ L < N, L being an integer).

26. The multi-port cache memory according to claim 13, wherein said tag memory consists of $L_{tag}$-port cell blocks having the number $L_{tag}$ of ports ($L_{tag}$ being an integer not less than one), and said data memory consists of $L_{data}$-port cell blocks having the number $L_{data}$ of ports ($L_{data}$ being an integer not less than one and differing from $L_{tag}$).

27. The multi-port cache memory according to claim 18, wherein the number M of said one-port cell blocks is less than the number N of ports of said N-port tag

memory and said N-port data memory.

28. The multi-port cache memory according to claim 18, wherein corresponding pairs of said N-port tag memories and said N-port data memories are combined to form combined N-port tag-data memories, and the word length of said combined N-port tag-data memories is represented by "mtag + $W * 2^{mword}$" where mtag represents the number of bits of the address allocated to the tag, mword represents the number of bits of the address, being 0 or more, allocated to the cache line offset, and W represents the word length of an instruction or a data word.

29. The multi-port cache memory according to claim 18, wherein said cell blocks included in said N-port tag memory and said N-port data memory consist of L-port cell blocks having the number L of ports not less than 1 and less than N (1 □ L < N, L being an integer).

30. The multi-port cache memory according to claim 18, wherein said tag memory consists of $L_{tag}$-port cell blocks having the number $L_{tag}$ of ports ($L_{tag}$ being an integer not less than one), and said data memory consists of $L_{data}$-port cell blocks having the number $L_{data}$ of ports ($L_{data}$ being an integer not less than one and differing from $L_{tag}$).

31. An N-port tag memory, comprising:

an M-number of one-port cell blocks, M being an integer of one or more;

a global switching network serving to impart N-port multi-port functions to the M-number of one-port cell blocks, N being an integer of more than one; and

connections for a conflict management circuit connected to control the global switching network, consisting, for example, of a bus system or a crossbar switch, in the case of access conflicts between the N-ports,

wherein the outputs of a conflict management circuit and, for each of the N ports, a first cache line index for identifying the contents of any one or any plurality of the M-number of one-port cell blocks, a second cache line index for

selecting any one or any plurality of the M-number of one-port cell blocks, and a read/write instruction transmitted from a microcomputer core are supplied to at least the global switching network.

32. The N-port tag memory according to claim 31, wherein the number M of said one-port cell blocks is less than the number N of ports of said N-port tag memory.

33. The N-port tag memory according to claim 31, wherein said N-port tag memory and an N-port data memory forming a pair with said N-port tag memory are combined to form a combined N-port tag-data memory, and the word length of said combined N-port tag-data memory is represented by "$mtag + W * 2^{mword}$" where mtag represents the number of bits of the address allocated to the tag, mword represents the number of bits of the address, being 0 or more, allocated to the cache line offset, and W represents the word length of an instruction or a data word.

34. The N-port tag memory according to claim 31, wherein said cell blocks included in said N-port tag memory are L-port cell blocks having the number L of ports not less than 1 and less than N ($1 \square L < N$, L being an integer).

35. The N-port tag memory according to claim 31, wherein said tag memory consists of $L_{tag}$-port cell blocks having the number $L_{tag}$ of ports ($L_{tag}$ being an integer not less than one), and an N-port data memory forming a pair with said N-port tag memory consists of $L_{data}$-port cell blocks having the number $L_{data}$ of ports ($L_{data}$ being an integer not less than one and differing from $L_{tag}$).

36. An N-port data memory, comprising:

an M-number of one-port cell blocks, M being an integer of one or more;

a global switching network serving to impart an N-port multi-port function to the M-number of one-port cell blocks, N being an integer of more than one; and

connections for a conflict management circuit connected to control the

global switching network consisting, for example, of a bus system or a crossbar switch, in the case of conflicts between the N ports,

wherein the outputs of a conflict management circuit, and for each of the N ports, a first cache line index for identifying the contents of any one or any plurality of the M-number of one-port cell blocks, a second cache line index for selecting any or any plurality of the M-number of one-port cell blocks, a cache line offset allowing the cache line to consist of more than one data word, and a read/write instruction transmitted from a microcomputer core are supplied to at least the global switching network, and instructions or data words are transmitted to or from the global switching network.

37. The N-port data memory according to claim 36, wherein the number M of said one-port cell blocks is less than the number N of ports of said N-port data memory.

38. The N-port data memory according to claim 36, wherein said N-port data memory and an N-port tag memory forming a pair with said N-port data memory are combined to form a combined N-port tag-data memory, and the word length of said combined N-port tag-data memory is represented by "$mtag + W * 2^{mword}$" where mtag represents the number of bits of the address allocated to the tag, mword represents the number of bits of the address, being 0 or more, allocated to the cache line offset, and W represents the word length of an instruction or a data word.

39. The N-port data memory according to claim 36, wherein said cell blocks included in said N-port data memory are L-port cell blocks having the number L of ports not less than 1 and less than N ($1 \square L < N$, L being an integer).

40. The N-port data memory according to claim 36, wherein a tag memory forming a pair with said data memory consists of $L_{tag}$-port cell blocks having the number $L_{tag}$ of ports ($L_{tag}$ being an integer not less than one), and said data

memory consists of $L_{data}$-port cell blocks having the number $L_{data}$ of ports ($L_{data}$ being an integer not less than one and differing from $L_{tag}$).

41. An N-port tag memory, comprising:

an M-number of one-port cell blocks, M being an integer of one or more;

a port transition circuit for converting the function of the one-port cell block to the function of an N-port block, N being an integer more than one;

an M-number of N-port blocks the function of which has been obtained by mounting the port transition circuit to each of the M-number of one-port cell blocks;

a circuit network performing the address decoding function for N-ports to be connected to the M-number of N-port blocks; and

connections for a conflict management circuit to control in case of an access conflict the circuit network performing the address decoding function for the M-number of N-port blocks;

wherein, for each of the N ports, a first cache line index for identifying the contents of any one or any plurality of the M-number of one-port cell blocks, and a read/write instruction from a microcomputer are supplied to at least the port transition circuits, and the outputs of a conflict management circuit, and, again for each of the N ports, a second cache line index for selecting any one or any plurality of the M-number of one-port cell blocks, and a read/write instruction from a microcomputer core are supplied to at least the circuit network performing the address decoding function for the M-number of N-port blocks.

42. The N-port tag memory according to claim 41, wherein the number M of said one-port cell blocks is less than the number N of ports of said N-port tag memory.

43. The N-port tag memory according to claim 41, wherein said N-port tag memory and an N-port data memory forming or pair with said N-port tag memory

are combined to form combined N-port tag-data memory, and the word length of said combined N-port tag-data memory is represented by "mtag + $W * 2^{mword}$" where mtag represents the number of bits of the address allocated to the tag, mword represents the number of bits of the address, being 0 or more, allocated to the cache line offset, and W represents the word length of an instruction or a data word.

44. The N-port tag memory according to claim 41, wherein said N-port blocks included in said N-port tag memory consist of L-port cell blocks having the number L of ports not less than 1 and less than N (1 □ L < N, L being an integer), and a port transition circuit for converting the function of the L-port cell block to the function of the N-port block.

45. An N-port data memory, comprising:

an M-number of one-port cell blocks, M being an integer of one or more;

a port transition circuit for converting the function of the one-port cell block to the function of an N-port block, N being an integer more than one;

an M-number of N-port blocks the function of which has been obtained by mounting the port transition circuit to each of the M-number of one-port cell blocks;

a circuit network performing the address decoding function for N-ports to be connected to the M-number of N-port blocks; and

connections for a conflict management circuit to control in case of an access conflict the circuit network performing the address decoding function for the M-number of N-port blocks,

wherein, for each of the N ports, a first cache line index for identifying the contents of any one or any plurality of the M-number of one-port cell blocks, a cache line offset allowing the cache line to consist of more than one data word, and a read/write instruction from a microcomputer are supplied to at least the port

transition circuits, and the outputs of a conflict management circuit, and, again for each of the N ports, a second cache line index for selecting any one or any plurality of the M-number of one-port cell blocks, a read/write instruction from a microcomputer core, are supplied to at least the circuit network performing the address decoding function for the M-number of N-port blocks, and data words or instructions are transmitted to or from the circuit network performing the address decoding function of the M-number of N-port blocks.

46. The N-port data memory according to claim 45, wherein the number M of said one-port cell blocks is less than the number N of ports of said N-port data memory.

47. The N-port data memory according to claim 45, wherein an N-port tag memory forming a pair with said N-port data memory and said N-port data memory are combined to form a combined N-port tag-data memory, and the word length of said combined N-port tag-data memory is represented by "mtag + $W * 2^{mword}$" where mtag represents the number of bits of the address allocated to the tag, mword represents the number of bits of the address, being 0 ore more, allocated to the cache line offset, and W represents the word length of an instruction or a data word.

48. The N-port data memory according to claim 45, wherein said N-port blocks included in said N-port data memory consist of L-port cell blocks having the number L of ports not less than 1 and less than N ($1 \square L < N$, L being an integer), and a port transition circuit for converting the function of the L-port cell block to the function of the N-port block.

49. An N-port tag memory, comprising:

an $M_B$-number of one-port cell blocks, where $M_B$ is represented by $M * M_S$, each of $M_S$ and M being an integer of one or more;

an $M_S$-number of global switching networks each serving to impart N-port

multi-port functions to an M-number of one-port cell blocks, N being an integer of more than one; and

an $M_S$-number of connections for conflict management circuits connected to control the global switching networks, consisting, for example, of a bus system or a crossbar switch, in the case of access conflicts between the N-ports,

wherein the outputs of a conflict management circuit and, for each of the N ports, a first cache line index for identifying the contents of any one or any plurality of the M-number of one-port cell blocks, a second cache line index for selecting any one or any plurality of the M-number of one-port cell blocks, and a read/write instruction transmitted from a microcomputer core are supplied to at least each of the global switching networks.

50. An N-port data memory, comprising:

an $M_B$-number of one-port cell blocks, where $M_B$ is represented by $M*M_S$, each of $M_S$ and M being an integer of one or more;

an $M_S$-number of global switching networks each serving to impart an N-port multi-port function to an M-number of one-port cell blocks, N being an integer of more than one; and

an $M_S$-number of connections for conflict management circuits connected to control the global switching networks consisting, for example, of a bus system or a crossbar switch, in the case of conflicts between the N ports,

wherein the outputs of a conflict management circuit, and for each of the N ports, a first cache line index for identifying the contents of any one or any plurality of the M-number of one-port cell blocks, a second cache line index for selecting any one or any plurality of the M-number of one-port cell blocks, a cache line offset allowing the cache line to consist of more than one data word, and a read/write instruction transmitted from a microcomputer core are supplied to at least each of the global switching networks, and instructions or data words are

transmitted to or from each of the global switching networks.

51. An N-port tag memory, comprising:

an $M_B$-number of one-port cell blocks, where $M_B$ is represented by $M*M_S$, each of $M_S$ and M being an integer of one or more;

a port transition circuit for converting the function of the one-port cell block to the function of an N-port block, N being an integer more than one;

an $M_B$-number of N-port blocks the function of which has been obtained by mounting the port transition circuit to each of the $M_B$-number of one-port cell blocks;

an $M_S$-number of circuit networks performing the address decoding function for N-ports to be connected to an M-number of N-port blocks; and

an $M_S$-number of connections for conflict management circuits to control in case of an access conflict the respective circuit network performing the address decoding function for the M-number of N-port blocks;

wherein, for each of the N ports, a first cache line index for identifying the contents of any one or any plurality of the M-number of one-port cell blocks, and a read/write instruction from a microcomputer are supplied to at least each of the port transition circuits, and the outputs of a conflict management circuit, and, again for each of the N ports, a second cache line index for selecting any one or any plurality of the M-number of one-port cell blocks, and a read/write instruction from a microcomputer core are supplied to at least each of the circuit networks performing the address decoding function for the M-number of N-port blocks.

52. An N-port data memory, comprising:

an $M_B$-number of one-port cell blocks, where $M_B$ is represented by $M*M_S$, each of $M_S$ and M being an integer of one or more;

a port transition circuit for converting the function of the one-port cell block to the function of an N-port block, N being an integer more than one;

an $M_B$-number of N-port blocks the function of which has been obtained by mounting the port transition circuit to each of the $M_B$-number of one-port cell blocks;

an $M_S$-number of circuit networks performing the address decoding function for N-ports to be connected to an M-number of N-port blocks; and

an $M_S$-number of connections for conflict management circuits to control in case of an access conflict the respective circuit network performing the address decoding function for the M-number of N-port blocks,

wherein, for each of the N ports, a first cache line index for identifying the contents of any one or any plurality of the M-number of one-port cell blocks, a cache line offset allowing the cache line to consist of more than one data word, and a read/write instruction from a microcomputer are supplied to at least each of the transition circuits, and the outputs of a conflict management circuit, and, again for each of the N ports, a second cache line index for selecting any one or any plurality of the M-number of one-port cell blocks, and a read/write instruction from a microcomputer core, are supplied to at least each of the circuit networks performing the address decoding function for the M-number of N-port blocks, and data words or instructions are transmitted to or from each of the circuit networks performing the address decoding function of the M-number of N-port blocks.